PowerRack HV4

User Manual

Content

Statement of Law

This product complies with the design requirements of environmental protection and personal safety. The storage, use and disposal of the products shall be carried out in accordance with the product manual, relevant contract or relevant laws and regulations.

Customer can check the related information on the website of Daqin New Energy Tech (Taizhou) Co., Ltd when the product or technology is updated. Web URL: http://www.dyness-tech.com

Please note that the product can be modified without prior notification.

Manual Version: V1.0

Revision History

Revision NO.	Revision Date	Revision Reason
1.0	2023.03.02	First Published

Safety Precautions

Warning

- Please do not put the battery into water or fire, in case of explosion or any other situation that might endanger your life.
- Please connect wires properly while installation, do not reverse connect.
- To avoid short circuit, please do not connect positive and negative poles with conductor on the same device.
- Please avoid any form of damage to battery, especially stab, hit, trample or strike.
- Please shut off the power completely when removing the device or reconnecting wires during the daily use or it could cause the danger of electric shock.
- Please use dry powder extinguisher to put out the flame when encountering a fire hazard, liquid extinguisher could result in the risk of explosion.
- For your safety, please do not arbitrarily dismantle any component in any circumstances. The maintenance must be implemented by authorized technical personnel or our company's technical support.Device breakdown due to unauthorized operation will not be covered under warranty.

Caution

- The products have been strictly checked before shipment. Please contact us if you find any abnormal phenomena such as device outer case bulging.
- In order to ensure safety and normal use of the product, the equipment should be grounded properly before use.
- To assure the product normal operation, please make sure parameters among the relevant device are compatible and matched.
- Please do not mixed-use batteries from different manufacturers, different types and models, as well as old and new together.
- Ambient and storage method could impact the product life span, please comply with the operation environment instruction to ensure device works in proper condition.
- For long-term storage, the battery should be recharged once every 3 months, and the amount of electric charge shall exceed 80% of the rated capacity.
- Please charge the battery in 18 hours after it fully discharged or over-discharging protection mode is activated.
- Formula of theoretical standby time: T=C/I (T is standby time, C is battery capacity, I is total current of all loads).

Preface

Manual declaration

PowerRack HV4 battery energy storage system can provide energy storage function for photovoltaic power generation users. Our product can store extra electricity into battery from photovoltaic power generation system in daytime and supply stable power to user's equipment as power backup at nighttime or any time when needed. It can improve the efficiency of photovoltaic power generation and increase the electric power efficiency by peak load shifting.

This user manual details the basic structure, parameters, basic procedures and methods of installation and operation and maintenance of the equipment.

1 Introduction

1.1 Brief Introduction

HV51100 lithium iron phosphate battery system is a high voltage battery system unit, customers can choose a certain number of HV51100 according to their needs, by connecting series to form a PowerRack HV4, to meet the user's long-term power supply needs. The product is especially suitable for application scene of high power, limited installation space, long power backup time and long service life.

1.2 Product Properties

HV51100 energy storage product's positive electrode materials are lithium iron phosphate, battery cells are managed effectively by BMS with better performance, the system's features as below:

- Comply with European ROHS, Certified SGS, employ non-toxic, non-pollution environment-friendly battery.
- Anode materials are lithium iron phosphate (LiFePO4), safer with longer life span.
- Carries battery management system with better performance, possesses protection function like over-discharge, over-charge, over-current, abnormal temperature.
- Self-management on charging and discharging, Single core balancing function.
- Intelligent design configures integrated inspection module.
- Flexible configurations allow parallel of multi battery for longer standby time.
- Self-ventilation with lower system noise.
- Less battery self-discharge, then recharging period can be up to 10 months during the storage.
- No memory effect so that battery can be charged and discharged shallowly.
- With wide range of temperature for working environment, -20℃ ~ +55℃, circulation span and discharging performance are well under high temperature.
- Less volume, lighter weight.

1.3 Product identity definition

Battery Energy Storage System nameplate

DYNESS
ENERGY STORAGE SYSTEM

Model	Nominal Energy/kWh	Nominal Voltage/V	Nominal Capacity/Ah	Ambient Temp/℃	IP Grade	Protective Class
☐ HV4-4S	20.48	204.8	100	0~50	20	I
☐ HV4-5S	25.6	256	100	0~50	20	I
☐ HV4-6S	30.72	307.2	100	0~50	20	I
☐ HV4-7S	35.84	358.4	100	0~50	20	I

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Figure1-1nameplate of Rack

DYNESS
ENERGY STORAGE SYSTEM

Model	Nominal Energy/kWh	Nominal Voltage/V	Nominal Capacity/Ah	Ambient Temp/℃	IP Grade	Protective Class
☐ HV4-8S	40.96	409.6	100	0~50	20	I
☐ HV4-9S	46.08	460.8	100	0~50	20	I
☐ HV4-10S	51.2	512	100	0~50	20	I
☐ HV4-11S	56.32	563.2	100	0~50	20	I

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Figure1-2nameplate of Rack

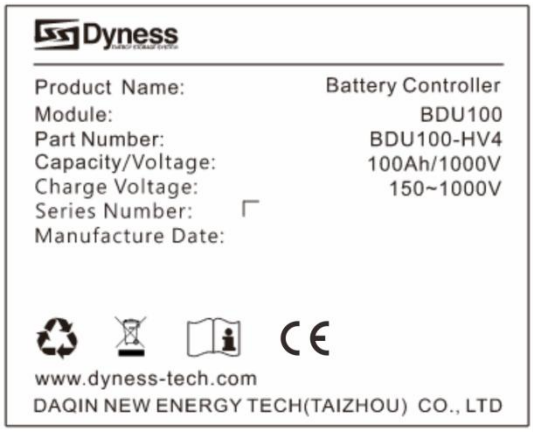


Figure1-3nameplate of BDU

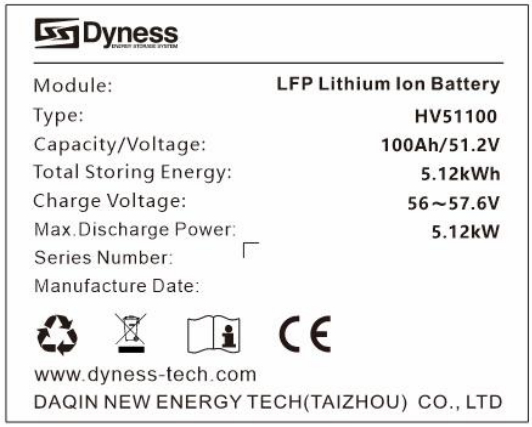


Figure1-4nameplate of HV51100

	**Battery voltage is higher than safe voltage, direct contact with electric shock hazard.**
	**Be careful with your actions and be aware of the dangers.**
	**Read the user manual before using.**
	**The scrapped battery cannot be put into the garbage can and must be professionally recycled.**
	**After the battery life is terminated, the battery can continue to be used after it recycled by the professional recycling organization and do not discard it at will.**
	**Dangerous goods warning label on the side of the battery module**

2 Product Specification

2.1 System Performance Parameter

Table 2-1 The parameter of PowerRack HV4 system-1

Item	PowerRack HV4 -4S	PowerRack HV4 -5S	PowerRack HV4 -6S	PowerRack HV4 -7S
Module Type	LFP	LFP	LFP	LFP
Nominal Voltage(V)	204.8V	256V	307.2V	358.4V
Work Voltage Range(V)	179.2~230.4	224~288	268.8~345.6	313.6~403.2
Module configuration	4 Series	5 Series	6 Series	7 Series
Nominal Energy(kWh)	20.48	25.6	30.72	35.84
Nominal Power(kW)	12.288	15.36	18.432	21.504
Max Power(kW)	20.48	25.6	30.72	35.84
Charging Current(A)	50	50	50	50
Discharge Current(A)	50	50	50	50
Dimension(mm)	601*610*1422	601*610*1422	601*610*1422	601*610*1422
Weight(kg)	237	290.5	344	397.5
Battery Module Name	HV51100	HV51100	HV51100	HV51100
Battery Module Quantity(pcs)	4	5	6	7

Table 2-2The parameter of PowerRack HV4 system-2

Item	PowerRack HV4 -8S	PowerRack HV4 -9S	PowerRack HV4 -10S	PowerRack HV4 -11S
Module Type	LFP	LFP	LFP	LFP
Nominal Voltage(V)	409.6V	460.8V	512V	563.2V
Work Voltage Range(V)	358.4~460.8	403.2~518.4	448~576	492.8~633.6
Module configuration	8Series	9 Series	10 Series	11 Series
Nominal Energy(kWh)	40.96	46.08	51.2	56.32
Nominal Power(kW)	24.576	27.648	30.72	33.792
Max Power(kW)	40.96	46.08	51.2	56.32
Charging Current(A)	50	50	50	50
Discharge Current(A)	50	50	50	50
Dimension(mm)	601*610*2062	601*610*2062	601*610*2062	601*610*2062
Weight(kg)	486	539.5	593	646.5
Battery Module Name	HV51100	HV51100	HV51100	HV51100
Battery Module Quantity(pcs)	8	9	10	11

Figure2-1 PowerRack HV4-11S

2.2Battery Module

Table 2-3Product parameter

Module Name	HV51100
Cell Technology	Li-ion(LFP)
Battery Module Capacity (kWh)	5.12
Battery Module Voltage (Vdc)	51.2
Battery Module Capacity (Ah)	100
Battery Module Charge Voltage (Vdc)	57.6
Battery Module Charge Current (Normal) [A]	50
Battery Module Discharge Current (Normal) [A]	50
Dimension(W*D*H, mm)	481*535*140
Communication	CAN/RS485
Pollution Degree (PD)	I
IP Grade	IP20
Weight(kg)	43.5

2.3 Interface Definition

This section elaborates the interface functions of the front interface of the device.

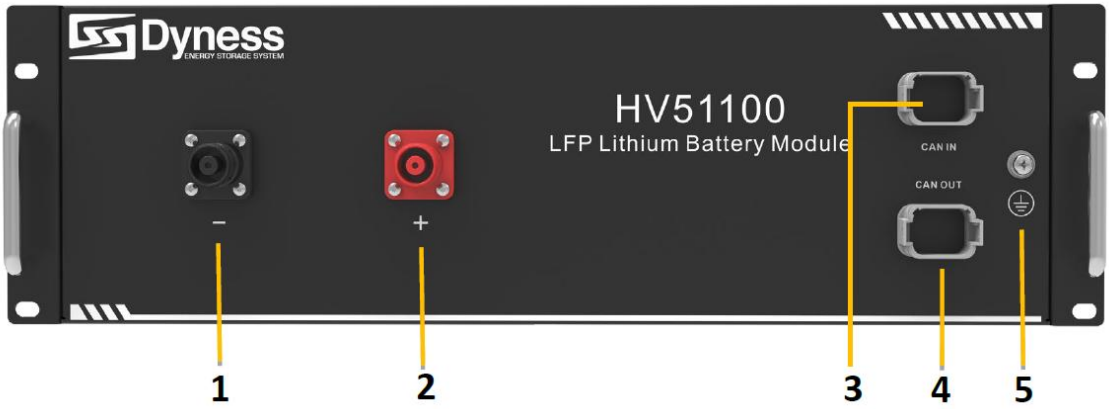


Figure2-2 The sketch of interface.

Table 2-4 Interface Definition

Item	Name	Definition
1	Negative socket	Battery output or Serial anode cable
2	Positive socket	Battery output or Serial anode cable
3	CAN IN	Quick plug communication port, connect to former module or BDU
4	CAN OUT	Quick plug communication port, connect to next module
5	Grounding	Shell ground connection

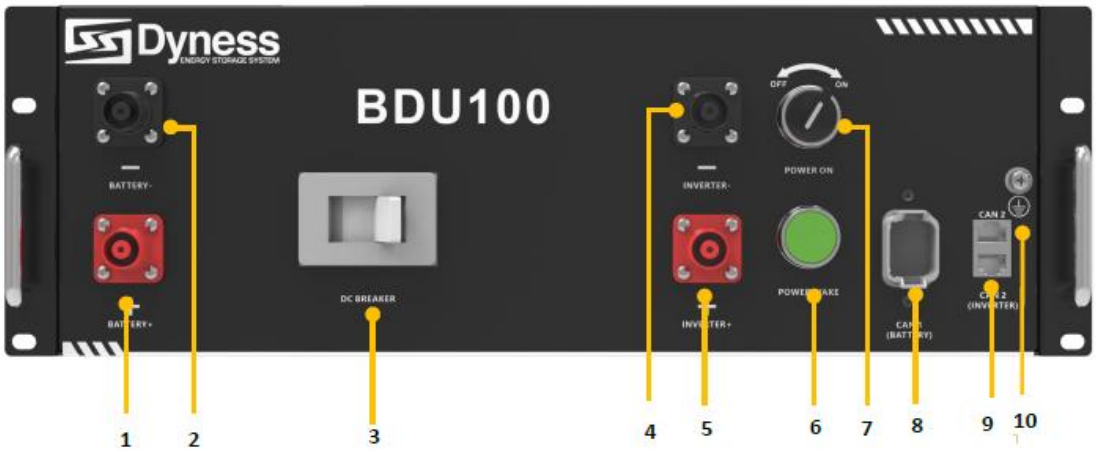


Figure2-3 The interface of BDU100

Table 2-5 Interface Definition

Item	Name	Definition
1	Positive socket	Battery input cable
2	Negative socket	Battery input cable

Item	Name	Definition
3	DC Breaker	The master switch of the battery system，you must switch on it before switching on power on&power wake switch; Short circuit protection.
4	Negative socket	Battery output cable
5	Positive socket	Battery output cable
6	Power Wake Button	Long press this button to start the battery system
7	Power On switch	Turn on the switch to power the BMS system
8	CAN 1	Quick plug communication port between battery module and BDU
9	CAN 2	RJ45 communication port between the battery system and inverter
10	Grounding	Shell ground connection

2.3.1 Communicationport

Figure 2-4 CAN interface definition

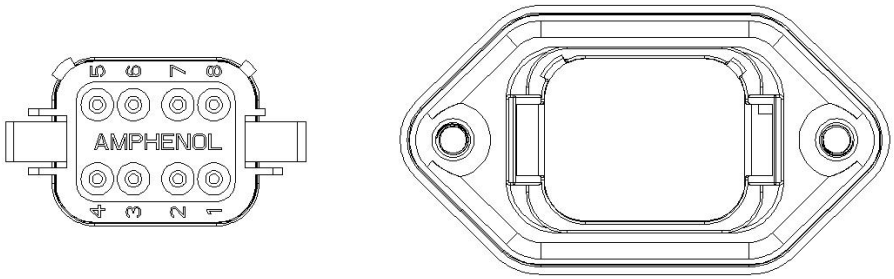


Table 2-6 BDU CAN1 & Battery CANPin Definition

Foot position	Color	Definition
PIN1	Red	24V+
PIN2	Black	24V-
PIN3	White	SCANACC
PIN4	Blue	SWAKE
PIN5	Yellow	SCANH
PIN6	Green	SCANL
PIN7		
PIN8		

Figure 2-5 CAN interface definition

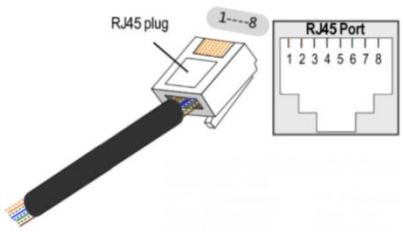


Table 2-7 BDU CAN2Pin Definition

Foot position	Color	Definition
PIN1	Orange/white	Reserve
PIN2	Orange	XGND
PIN3	Green/white	Reserve
PIN4	Blue	CANH
PIN5	Blue/white	CANL
PIN6	Green	CANIN
PIN7	Brown/white	CANOUT
PIN8	Brown	Reserve

2.4 Battery Management System(BMS)

2.4.1 Voltage Protection

Low Voltage Protection in Discharging：

When any battery cell voltage or total voltage is lower than the rated protection value during discharging, the over-discharging protection is activated. Then battery system stops supplying power to the outside. When the voltage of each cell back to rated return range, the protection is over.

Over Voltage Protection in Charging:

Battery will stops charging when total voltage or any battery cell voltage reaches the rated protection value during charging stage. When total voltage or all cell back to rated range, the protection is over.

2.4.2 Current Protection

Over Current Protection in Charging:

When the charge current is higher than the protection value, the system stops charging. Protection is released after rated time delayingor charging currentreleased.

Over Current Protection in Discharging:

When the discharge current is higher than the protection value, the system stops discharging. Protection is released after rated time delayingordischarging currentreleased.

2.4.3 Temperature Protection

Low/Over temperature protection in charging:

When battery's temperature is beyond range of 0℃~+55℃ during charging, temperature protection is activated, device stops charging.

The protection is over when temperature back to rated working range.

Low/Over temperature protection in discharging:

When battery's temperature is beyond range of -10 ℃ ~+55 during discharging, temperature protection is activated, device stops supplying power to the outside.
The protection is over when temperature back to rated working range..

Caution

Battery's maximum discharging current should be more than load's maximum working current.

3 Installation and Configuration

3.1 Preparation for installation

Safety Requirement

This system can only be installed by personnel who have been trained in the power supply system and have sufficient knowledge of the power system.
The safety regulations and local safety regulations listed below should always be followed during the installation.

- All circuits connected to this power system with an external voltage of less than 48V must meet the SELV requirements defined in the IEC60950 standard.
- If operating within the power system cabinet, make sure the power system is not charged. Battery devices should also be switched off.
- Distribution cable wiring should be reasonable and has the protective measures to avoid touching these cables while operating power equipment.
- when installing the battery system, must wear the protective items below:

The isolation gloves Safety goggles Safety shoes

Figure3-1

3.1.1 Environmental requirements

- Working temperature: -10℃ ~ +55℃
- Charging temperature range is 0℃~+55℃
- Discharging temperature range is -10℃ ~+55℃
- Storage temperature: 5 ~ +45℃
- Relative humidity: 5% ~ 85%RH
- Elevation: no more than 4000m
- Operating environment: Indoor installation, sites avoid the sun and no wind, no conductive dust and corrosive gas.

And the following conditions are met:

- Installation location should be away from the sea to avoid brine and high humidity environment.
- The ground for product arrangement shall be flat and level.
- There is no flammable explosive materials near to the installation site.
- The optimal ambient temperature is 5℃~ 45℃
- Keep away from dust and messy zones.
- The installation site must be equipped with fire-extinguisher system for safety purpose.

3.1.2 Tools and data

Hardware tool
Tools and meters that may be used are shown in table 3-1.

Table 3-1 Tool instrument

Name	
Screwdriver（Slotted、Phillips）	Multimeter
Torque wrench	Clamp current meter
Diagonal pliers	Insulation tape
Pointed nose pliers	Temperature meter
Pliers to hold the wire	Anti-static bracelet
Stripping pliers	Cable tie
Electric drill	Tape measure

3.1.3 Technical preparation

Electrical interface check

Devices that can be connected directly to the battery can be user equipment, power supplies, or other power supplies.

- Confirm whether the user's PV power generation equipment, power supply or other power supply equipment has a DC output interface, and measure whether the DC power output voltage meets the voltage range requirements in Table 2-1andTable2-2.
- Confirm that the maximum discharge current capability of the DC power interface of the user's photovoltaic power generation equipment, power supply or other power supply equipment should be higher than the maximum charging current of the products used in Table 2-1andTable2-2.
  If the maximum discharge capacity of the DC power interface of the user's photovoltaic power generation equipment is less than the maximum charging current of the products used in Table 2-1andTable2-2, the DC power interface of the user's photovoltaic power generation equipment shall have a current limiting function to ensure the normal operation of the user's equipment.
- Verify that the maximum operating current of the battery-powered user equipment (inverter DC input) should be less than the maximum discharge current of the products used in Table 2-1andTable2-2.

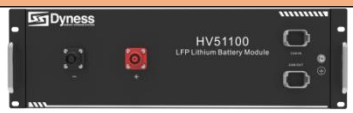
The security check

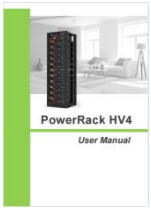
- Firefighting equipment should be provided near the product, such as portable dry powder fire extinguisher.
- Automatic fire fighting system shall be provided for the case where necessary.
- No flammable, explosive and other dangerous materials are placed beside the battery.

3.1.4Unpacking inspection

- When the equipment arrives at the installation site, loading and unloading should be carried out according to the rules and regulations, to prevent frombeing exposed to sun and rain.
- Before unpacking, the total number of packages shall be indicated according to the shipping list attached to each package, and the case shall be checked for good condition.
- In the process of unpacking, handle with care and protect the surface coating of the object.
- Open the package, the installation personnel should read the technical documents, verify the list, according to the configuration table and packing list, ensure objects are complete and intact, if the internal packing is damaged, should be examined and recorded in detail.

Packing list of PowerRack HV4-11s is as follows:

Item	Specification	Quantity	Figure
Battery-HV51100	51V/100Ah 480×535×133mm	11	
BDU100	480×410×155mm	1	
Power cable-positive	Red /35mm²/L3000mm	1	
Power cable-negative	Black /35mm²/L3000mm	1	
Serial cable	Orange /35mm²/L215mm	10	
Module cable-positive	Orange /35mm²/L215mm	1	
Module cable-negative	Orange /35mm²/L2200mm	1	

Communication parallel cable	Quick plug communication port	11	
Communication cable-to inverter	Black /L3000mm /Double RJ45 plug	1	
OT terminal	OT4-6	2	
User Manual	PowerRack HV4 User manual	1	
Screw	Combination screws M6*14	48	
CAN resistor	120 Ω	1	

3.1.5 Engineering coordination

Attention should be paid to the following items before construction:

- Power line specification.
  The power line specification shall meet the requirements of maximum discharge current for each product.
- Mounting space and bearing capacity.
  Make sure that the battery has enough room to install, and that the battery rack and bracket have enough load capacity.
- Wiring.
  Make sure the power line and ground wire are reasonable. Not easy to short-circuit, water and corrosion.

3.2 Equipment installation

Table 3-2 Installation steps

Step 1	Mechanical installation	1.Battery placement position determination
		2.Battery module installation
		3.BDU installation
Step3	Electrical installation	1.Ground cable installation
		2.Battery module serial cable installation
		3.Connect the module cable-positivefrom the battery “+” to the BDU “+”
		4.Connect the module cable-negativefrom the battery “-” to the BDU “-”
		5. Connect the CAN 2 of the BDU with the CAN IN of the battery module with the communication parallel cable, then connect the CAN OUT of the previous battery module with the CAN IN of the next battery module in turn.
Step4	Battery system self-test	1.Turn the BDU ‘DC Breaker’ ON/OFF switch to the "ON" state
		2.Turn the‘Power ON’ ON/OFF switch to the "ON" state
		3.Press ‘POWER WAKE’ button 10S to wake up battery
		4.Check the system output voltage and ‘POWER WAKE’led status
		5. Shut down the system
Step5	Connecting inverter	1.Connect total positive & total negative cable of the battery system to the inverter
		2.Connect the communication cable from the master CAN 2 to the inverter
		3.Close the DC breaker
		4.Turn on the ‘Power ON’ switch , wake up system by ‘POWER WAKE’ button
		5.Turn on the inverter and check the communication between inverter and battery system

3.2.1 Installation preparation

1. Make sure the environment is meeting all technical requirements: “3.1.1”
2. Prepare equipment and tools for installation.
3. Confirm that the DC breaker is in the OFF state to ensure that it is no live operation.

3.2.2Mechanical installation

Installation method:

1. Place the HV51100 unit on the rack bracket as shown in the figure and push the device into the rack at the installation position. (The rack structure in the figure is for reference only)

Figure3-2

2. Secure the HV51100 unit to the rack with a nut through the mounting holes top on the hanging ears of the HV51100 unit.

Figure3-3

3. Insert the second one HV51100 in to the rack.

Figure3-4

4. Stack the required number of battery and BDU as described above, and use 4 screws to fix the battery and BDU on the front bracket. Shown as Figure3-5.

Figure3-5

3.2.3 Electrical installation

Before connecting the power cables, use multimeter to measure cable continuity, short circuit, confirm positive and negative, and accurately mark the cable labels.

Measuring methods：

- Power cable check: select the buzzer mode of multimeter and detect the both ends of the same color cable. If the buzzer calls, it means the cable is in good condition.

- Short circuit judgment: choose multimeter resistor file, probe the same end of positive and negative pole, if the resistor shows infinity, means that the cable is available.
- After visual testing of power line connection, the positive and negative poles of the battery shall be connected respectively to the positive and negative poles of the opposite terminal.

It is better to add a circuit breaker between the inverter and the battery system.

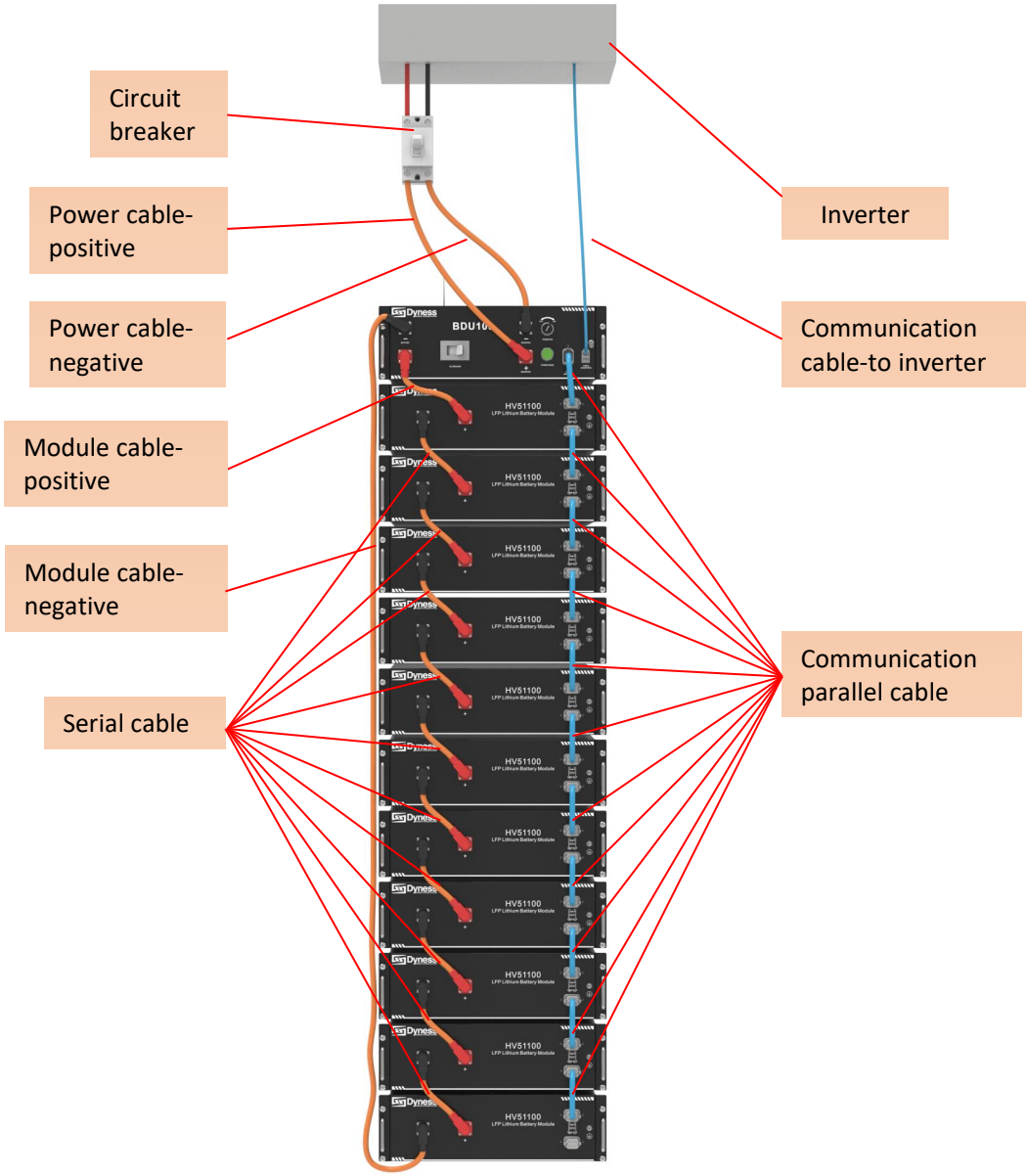


Figure3-6

3.2.4 Battery system self-test

- Switch the DC BREAKER of BDU to the "ON" state

- Switch on the “POWER ON” switch

3.2.4.2 Press the “POWER WAKE” button for about 10S. The system start-up.

3.2.4.3 Use a multimeter to measure the output voltage on the positive and negative ports of the BDU. Confirm the voltage is within the normal range

3.2.4.4 The output voltage should conform to the voltage range in the table “Table 2-1/2 The parameter of PowerRack HV4 system”. Otherwise, the system will be not working properly.

Danger: The voltage of the battery is too high, please pay attention to do self-protection during the measurement.

3.2.5Shut down thesystem

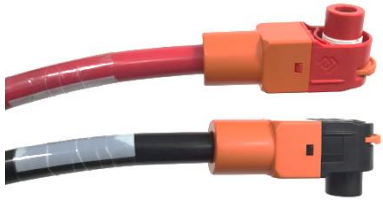
- Switch off the “POWER ON” switch.

- Switch the BDU “DC BREAKER” to the "OFF" state .

3.2.6 Connecting inverter

Caution: A external DC Breaker that operates both positive and negative conductors simultaneously between the BDU and inverter on the power cable is recommended. After waking up the BDU and ensure that the BDU is pre-charged, you can turn on it.

Danger:
Please confirm that the battery system is in the off state before connecting. It may cause electric shock to personnel and damage to the inverter if connect the battery directly without power off.
Connect the positive and negative connectors with the positive and negative power lines together. Both ends must have connectors, and the connector on the inverter side is provided by the inverter. If that 2m power cable is not long enough, please find another power cable of the same specification, the length cannot be longer than 3m.



- Connect External Power Cable to the inverter;

Connect to inverter DC+ terminal　　Connect to inverter DC- terminal

- Connect the INVERTER-CAN communication cable to the inverter RJ45 CAN port.

Connect to inverter RJ45 CAN communication port

Warning:
Double check all the power cables and communication cable. Make sure the voltage of the Inverter is in thesame level with the battery system.

- Switch on the inverter, to make sure all the power equipment can work normally.
- Start the battery system. Referring to the section “3.2.4”.

3.2.7 Register on the website after installation

After the battery system installation is completed and the running is normal, you need to log in to the DYNESS official website to register the product installation and use information to make the product warranty effective. Please follow the instructions on the website to register.

http://www.dyness-tech.com ServiceSi[illegible]

4 Maintenance

4.1 Trouble shooting

Danger: The PowerRack HV4 battery system is a high voltage DC system, operated by professional and authorized person only.
Danger: Before check the failure, must check all the cables connection. Switches are right or not (refer to section 3.2.4), and if the battery system can be woken up normally.

No	Problem	Possible Reason	Solution
1	The battery has no voltage output, and “POWER ON”/ “POWER WAKE” Light is off.	The DC breaker of the BDU didn’t be turned on	Turn on the DC breaker of BDU
2		The "POWER ON" switch of the BDU box was not switched on	Switch on the "POWER ON" button
3		Battery is in sleep state.	Long press the "POWER WAKE" button for about 10S
4		Battery gets into over-discharged protection	Charge the battery to relieve the protection state
5	The battery has no voltage output, but “POWER ON”/ “POWER WAKE” are on	The relay in BDU is faulty	Replace a new BDU directly
6	When the battery is connected to the inverter, the DC breaker trips automatically	The circuit between the battery and the inverter has a short circuit point	Check whether there is a short circuit in the circuit between the battery and the inverter； Check if the inverter is faulty
7	Communication failure between battery and inverter	The wrong battery model type is selected on the inverter	Select correct battery model type on the inverter

4.2 Replacement of main component

Danger: The PowerRack HV4 battery system is a high voltage DC system, only can be operated by professional and authorized person.

4.2.1 Replacement of Battery Controller (BDU)

4.2.1.1 Turn off the whole battery system. Ensure the Negative terminal and Positive terminal have no power. The shutdown progress refers to section 3.2.5

4.2.1.2 Remove thefourscrewsontheBDUand remove theBDUfromthesystem.

4.2.1.3 Change a new BDU. Then fix four screws.

4.3 Battery Maintenance

Danger: The maintenance of battery only can be operated by professional and authorized person.
Danger:you need turn off the battery system firstly when you do some maintenance items.

4.3.1 Voltage Inspection:

[Periodical Maintenance] Check the voltage of battery system through the monitor software. Check whether the system voltage is normal or not. For example: Check Single cell's voltage is out of rated range or not.

4.3.2 Voltage Inspection:

[Periodical Maintenance] Check the SOC of battery system through the monitor software. Check the SOC of battery string is normal or not.

4.3.3 Cables Inspection:

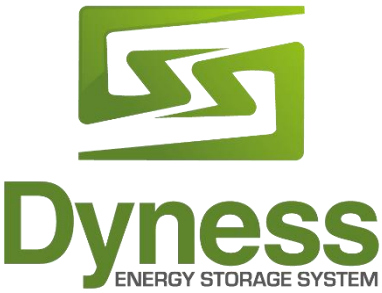
[Periodical Maintenance]Visual inspect all the cables of battery system. Check the cables have broken, aging, getting loose or not.

4.3.4 Balancing:

[Periodical Maintenance] The battery system will become unbalanced if have not be charged fully for a long time. Solution: Preform the balancing maintenance (fully charged)every 3 month. Generally, this maintenance progress needs to be completed when external devices such as the monitor software and battery and inverter are in good communication.

4.3.4 Output Relay Inspection:

[Periodical Maintenance] Under low load condition (low current), control the output relay OFF and ON to hear the relay has click voice, that's mean this relay can off and on normally.



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